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A SYSTEM FOR INTEGRATED MOBILE DEVICES

Field of Invention

The present invention relates to a system for mobile devices, and more specifically, to a system for a plurality of integrated mobile devices.

Background of the Invention

A conventional data collection system may include a mobile unit utilizing applications software to collect and process data by a sequence of automated and/or manual operations. A typical automated process is the non-contact scanning of bar code data by means of a cyclically deflected laser beam or an image photosensor of the CCD type. Once a valid bar code reading has been obtained, a keypad may be manually operated to indicate an associated quantity. The user may then manually initiate a further operation, for example, the on-line transmission of the data to a

remote host computer by a known means such as a radio frequency communications link.

Summary of the Invention

A system in accordance with the present invention includes a device management computer, a data concentrator computer for communicating with the device management computer, a gateway device for communicating with the data concentrator computer, and a plurality of mobile data acquisition devices. Each of the plurality of mobile data acquisition devices communicates with the gateway device. The gateway device performs pre-processing functions on data collected by the plurality of mobile data acquisition devices prior to transferring the data to the data concentrator computer.

Another system in accordance with the present invention transfers data. The system includes a device management computer, a data concentrator computer for communicating with the device management computer, a gateway device for communicating with the data concentrator computer, and a plurality of data acquisition devices. Each of the plurality of data acquisition devices communicates with the gateway device. The gateway device performs pre-processing

functions on data collected by the plurality of data acquisition devices prior to transferring the data to the data concentrator computer. The data concentrator computer processes and stores data collected by the plurality of data acquisition devices.

A computer program product in accordance with the present invention controls a communication network. The computer program product includes a first instruction for collecting transaction log files of a plurality of mobile devices by a device management computer, a second instruction for receiving a software package from the device management computer by a data concentrator computer, a third instruction for performing a self test by a gateway device and sending results of the self test to a workstation, a fourth instruction for decrypting data from the gateway device by the workstation, and a fifth instruction for synchronizing time between the plurality of mobile devices, the gateway device, the device management computer, the data concentrator computer, and the workstation.

Brief Description of the Drawings

The foregoing and other features of the present invention will become apparent to one skilled in the

art to which the present invention relates upon consideration of the following description of the invention with reference to the accompanying drawings, wherein:

Fig. 1 is a schematic representation of an example system in accordance with the present invention; and

Fig. 2A, 2B, and 2C are a schematic representation of another example system in accordance with the present invention.

Description of the Preferred Embodiment

Mobile devices have tremendous data processing power and flexibility in sending business application data to a centralized computer. Conventionally, a mobile device may communicate with a mobile device charging/communications cradle or dock. The communication interface from the cradle to the computer may be an RS-232 serial (or some form of RS-232). Typically, there is a one to one relationship between the computer and the cradle. Although a computer can support more than one serial cradle, the logistics of maintaining 90 cradles, for example, by a single computer may necessarily require computationally intensive activity. In the conventional approach, the

computer aggregates the data prior to sending a collection of data to a data concentrator computer.

Another conventional approach of concentrating 90 mobile devices by one computer is the aggregation of the mobile devices directly to a data concentrator computer. This approach has no mechanism to control or buffer data prior to transferring data to a centralized computer.

Still another conventional approach may include cradles that allow connectivity. However, the cradles necessarily communicate to the data concentrator concurrently. This approach is not efficient, particularly when a software download is required. For example, during a software update, each cradle requires great amounts of network bandwidth to transfer the entire software download to a mobile device. For 90 mobile devices, each mobile device would have a corresponding data concentrator for a software download session.

A system in accordance with the present invention may include an integrated mobile device services gateway for managing and controlling a plurality of mobile devices (i.e., 2 to N, where N is an integer greater than 1). Such a gateway may be positioned in

the same room or geographic location as cradles for the mobile devices so that a user may dock a mobile device for charging and data communication. The gateway may provide local device management, data and network security, and multiplexing for communication efficiency. The gateway may further reduce redundant network traffic in the case of all mobile devices receiving the same data or software. The gateway may transfer the data to a more local storage area and distribute the common data locally.

The system, or architecture, may process a variety of electrical communication applications allowing the mobile device services gateway to interface between several networked and non-networked computers. As stated above, a conventional approach utilizes a cradle with no local storage. The conventional cradle is connected to a personal computer with a display. The computer acts as a gateway for concentrating data and distributing software locally. For small quantities of mobile devices disposed in one location, the mobile device would communicate directly with the data concentrator, without a local computer. With this approach, each mobile device has an individual communication session with the data concentrator. For

example, if there were five mobile devices in a group to be updated, there would be five separate software download sessions.

A system in accordance with the present invention has a physical component that reduces the physical components of the conventional approach. A reduction of the quantity of parts may be reduced from 32 with the conventional approach to 16 with a system in accordance with the present invention. The lesser number of electrical devices may also reduce energy expended.

An example system in accordance with the present invention may include: a scaleable architecture from 2 to N mobile devices disposed in one physical location; system management functions integrated with business logic functions to reduce network traffic; management of one or more devices in groups or individually; and integration of installation and maintenance of physical components that require device specific data to be entered prior to operation.

The example system defines an architecture for two or more mobile devices communicating with one or more computers collecting business information from one or more locations (either same room or in different

cities). This system is applicable where there exists one or more human users of the mobile devices collecting predetermined information at multiple locations. The system utilizes the transfer of data from a mobile device to a computer that collects and processes data and provides mobile device management.

A system in accordance with the present invention provides reduced quantities of physical part numbers by standardizing component functions, a reduction of electrical parts, a reduction in electrical power consumption, a scalable architecture from 2 or more mobile devices located in a single physical location, the integration of system management functions with business logic functions to reduce network traffic, the management of one or more devices in groups or individually, and the integration of installing and maintaining physical components requiring device specific data to be entered prior to operation.

The example system 10 may have five main components. As shown in Fig. 1, the components may be a device management computer 20, one or more data concentrator computers 30, a workstation 40, a mobile device services gateway 50, and a plurality of mobile devices 80.

Depending on the amount of data to be collected, who collects the data, and where the data is collected may determine the specific quantity of physical system components (20, 30, 40, 50, 80). Each system component (20, 30, 40, 50, 80) may have the same system function independently of the quantity of components deployed. The example system 10 addresses the scalability of the system by keeping system functions identical, independent of quantity.

Geographically, the workstation 40, the mobile device services gateway 50, and the mobile devices 80 may be located in close proximity. A distance of the workstation 40, a printer 45, and the mobile devices 80 from the mobile device services gateway 50 may be dependent on the method for electrical communication. The device management computer 20 and the data concentrator computer(s) 30 may be located in a remote facility.

The complete example system 10 may include of multiple groups of workstations 40, mobile device services gateways 50, and mobile devices 80. Printers 45 may be optional peripherals to the example system 10.

The mobile devices 80 may be electronic devices that each have a computer processor, storage, display, keyboard and/or other automated input devices, batteries, and communication capability. The communication method for a mobile device 80 determines whether batch, near real time, or real time communications may occur. All communication methods may result in the mobile device 80 performing a communication session with a non-mobile device to transfer data to another component, typically a computer. The system 10 may use electrical, radio frequency, or optical communication methods. Some of these methods may be EIA RS-232, Universal Serial Bus; IEEE 802.3 Ethernet, IEEE802.5x Token Ring, IEEE 802.11x (where x is the one or more standards in this category), Wireless LAN, IEEE 802.3J Ethernet over Fiber (10BaseF), Fiber Distributed Data Interface, and/or Infrared Data Associated Interface.

The mobile device services gateway 50 may be a non-mobile device that transfers data between a mobile device 80 and a data concentrator computer 30. The mobile device services gateway 50 may provide the services for the mobile device 80 to communicate with other computers by transferring data via one or more

communication methods. It is not necessary for the communication method for data received from a mobile device 80 to match the communication method for the data to be transferred to the data concentrator computer 30. The mobile device services gateway 50 converts the data to the appropriate electrical interface required to transfer the data.

The mobile devices services gateway 50 provides storage for reducing communications as permitted by the business operation requirements. For example, if there were 156 mobile devices 80 supported by a mobile devices services gateway 50, a software update to all 156 mobile devices would be reduced to one software application update transfer between a data concentrator computer 30 and the mobile device services gateway. Storage of the software application may occur on the mobile device services gateway 50 after the software package has been received from the data concentrator computer 30. Each mobile device 80 may obtain a copy of the most recent software application update from the mobile device services gateway 50.

Computer peripherals such as a printer 45, a CD-ROM, a diskette drive, and/or other computer may be connected to the mobile device services gateway 50.

Since a mobile device 80 does not necessarily have computer peripherals, the mobile device, to print, may communicate with the mobile devices services gateway 50 to use the attached printer 45 or another network attached printer.

The data concentrator computer 30 supports the mobile devices 80 and groups of mobile devices deployed in the field. The data concentrator computer 30 may be dedicated or non-dedicated to a specific business software application. The data concentrator computer 30 supports the initial communications from the mobile devices 80 in the field. If business operations require collected data to be transferred to another computer or device, the data concentrator computer 30 may process, store, and communicate with another computer or device of the example system 10.

The device management computer 20 supports all devices used in the operation of the example system 10. The device management computer 20 may contain a centralized database configured by location, group within a location, and/or device. Device configuration information and software packages may be created or imported into the memory of the device management computer 20. Configuration information and software

packages may be distributed to the data concentrator computer(s) 30 for re-distribution to groups of mobile devices 80 located remotely from the device management computer 20. Data concentrator computer(s) 30, workstation(s) 40, mobile device services gateway(s) 50, and mobile devices 80 may be managed by the device management computer 20.

Additional computer resources may be needed for collecting device management data sent to the data concentrator computer(s) 30. A history database of collected data for generating management reports may also be maintained on the device management computer 20.

The workstation 40 may be a computer for interfacing with the mobile device services gateway 50. The workstation 40 may locally maintain data where the mobile devices 80 are being used and may provide a method for mobile devices to transfer data to a removable media device (dependent on the configuration of the system 10). Business data collected by the mobile devices 80 may be transferred to the workstation 40 via the mobile device services gateway 50. Software on the workstation 40 may provide an interface for additional mobile device services such

as exporting data to removable media (i.e., diskette, tape, CD-ROM, etc.), printing, and data processing (for reports and importing into other business applications.)

The mobile device(s) 80 may be configured, as needed, by the user to allow access to resources of the workstation 40 made available by the software operating for a specific function. Communications to the workstation 40 may be performed by one or more of the following electrical methods: electrical, radio frequency, or optical communications. As stated above, some of these methods may be EIA RS-232, Universal Serial Bus; IEEE 802.3 Ethernet, IEEE802.5x Token Ring, IEEE 802.11x (where x is the one or more standards in this category), Wireless LAN, IEEE 802.3J Ethernet over Fiber (10BaseF), Fiber Distributed Data Interface, and/or Infrared Data Associated Interface.

Relationships and functions internal to each of the physical components (20, 30, 40, 50, 80) of the example system 10 are described in Fig. 2. Within each physical component (20, 30, 40, 50, 80) the functions are categorized into: Business Application Functions, Internal Common Functions, and Interdependent Common Functions (as applicable).

Business Applications Functions are specific to the business process specific to the software. The example system 10 supports the interface to such software applications by providing common functions. Business Applications Functions use the common functions to create the desired behavior of the system 10.

Internal Common Functions are unique functions to a specific physical component (20, 30, 40, 50, or 80). For a mobile device 80, the Internal Common Functions may allow keypad input to an application or displaying data that is stored in the non-volatile storage area of the mobile device.

Interdependent Common Functions have a relationship that extends across the multiple physical components (20, 30, 40, 50, 80). Synchronizing time may be one function that extends across multiple physical components (20, 30, 40, 50, 80).

The following tables group the functions into physical components within the three previously defined categories. All functions defined for Business Applications are intended to be dependent on the business process in which the software is engineered to

automate. Business application functions are described in Table 1.

Table 1 - Business Application Functions

Function	Purpose
	Mobile Device
Collects business data via automated or human input	Provides for data input into the application
Processes business data	Provides for data processing
Display business data	Provides for viewing input or processed data
Stores business data	Provides for input or processed data storage
	Workstation
Provides business application specific processing	Keeps mobile device data local by processing, storing and viewing data
	Data Concentrator
Collects business data	Provides for aggregating business data across the entire system of all mobile devices
Processes business data	Provides for processing all collected business data across the system. Post processing may occur for changing the data format into a format used to interface with another computer in the system
Stores and/or transfers business data	Provides for storing, sharing, and/or transferring data

Mobile device internal common functions are described in Table 2.

Table 2 - Mobile Device Internal Common Functions

Function	Purpose
Automated Data Input	Collects input data from 1D and/or 2D barcode scanners; and digitizers, magnetic stripe readers. Data collected from these devices would have a consistent behavior available to the business application. An example of consistent behavior for automated data input may be a long beep when an input is unsuccessful.
Displays Data	Provides common display formats for consistent graphical user interface. For example, an energy indicator may be presented to the user in the form of a battery graphic showing the amount of remaining energy. The energy graphic would be a common display format.
Stores Data in Non-Volatile Memory	Manages locations of data within the device to allow asynchronous application programs to store data in a consistent method.
Provides Date/Time	A real time clock that allows for time stamping of all transactions that require recording time events. All system events will time stamp with the real time clock.

Function	Purpose
Communicates with Locally Attached Peripherals	Supports electrical interfaces from the mobile device to (but not limited) the peripheral such as printers, magnetic stripe readers, and wireless wide area networks.
Provides Mobile Device Common Services to Enable Multiple Mobile Software Business Applications	Allows for a common method to start, stop and run programs in parallel without losing data. Should one mobile device program be started and perform operations that collect data and a second program be run before the first program is completed, this function will know that there is data to be transferred when the mobile device communicates. Mechanisms for switching between the applications to preserve the state prior to being changed to another application is a common function that is provided as an interface to business applications.
Power Management	Monitors power utilization throughout the device based on state of the application behavior and user behavior. The common method of utilizing the power management function will insure the total recovery of a software application that was switched to a second program.

Function	Purpose
Performs Diagnostic Self Test	Local user and remote system initiated test to validate the hardware and software are performing properly. Results of this test are logged locally on the device until there exists a retention limit to purge the data.
Determines Need for Software Updates or Devices Specific Changes	A process to automatically determine whether the mobile device has the latest software or device specific information resident. If not, requests the appropriate function to update software or devices specific information. Should a software update be interrupted while downloading, the device will recover at the most recent data end of file.marker.
Performs Device Management	Self test data, performance data, and device specific data are integrated into a format for communications. If no data is found at the time of initiation, then the software process will attempt to recreate the data prior to communication. This task may not be always performed prior to all data communications. This task may be programmed to be exempt from execution when business rules and system management rules dictate.

Function	Purpose
Stores Device Specific Data	Configuration data is stored on the device in the non-volatile memory area. This data is used for the Device Management task and integrating the information into business applications.
Decrypts Data for Local Viewing	Data stored on the non-volatile memory area is encrypted. Only certain users, as determined by the site, will have access to view data.
Creates Integrated Communication Data Message	This function collects all the data elements that comprises a communication session prior to physically connecting to the Mobile Device Services Gateway.

Mobile device services gateway internal common functions are described in Table 3.

Table 3 - Mobile Device Services Gateway Internal Common Functions

Function	Purpose
Transfers Data Between Mobile Device and Data Concentrator; Mobile Device and Workstation; or Mobile Device and Data Concentrator and Workstation. Data may be transferred on any direction depending on the business application	Reads the predetermined data format and determines what to do with the data, where does the data get routed and protects the two networks from unauthorized intruders.

Function	Purpose
Provides Date/Time	A real time clock that allows for time stamping of all transactions that require recording time events. All system events will time stamp with the real time clock.
Performs Network Communications Authentication	User ID and Password are user or programmatically entered prior to network access authentication. This function performs the determination of whether authorization is required and if required, insures the correct information is manually or automatically inserted at the correct time.
Provides Network Isolation between Mobile Devices and Data Concentrator (and other network devices)	Internal firewall prevents the data from being transferred directly to the opposite network from which the data was entered. Eliminates intruders from gaining access to larger intranet.
Stores Device and Group Specific data	One local data store for device and group specific data.

Data concentrator computer internal common functions are described in Table 4.

Table 4 - Data Concentrator
Computer Internal Common Functions

Function	Purpose
Determines Need for Device Specific Distribution Database or Software Package update	A process to automatically determine whether the mobile device has the latest software or device specific information resident. If not, requests the appropriate function to update software or devices specific information. Should a software update be interrupted while downloading, the device will recover at the most recent data end of file marker.

Device management computer internal common functions are described in Table 5.

Table 5 - Device Management
Computer Internal Common Functions

Function	Purpose
Generates Reports	Provides the user with information about the system. Reports may be (but not limited to) 1) What Devices did not communicate in the last day, two days, etc. 2) How many devices are in this geographic area? 3) What devices do not have the latest software upgrade? 4) How many devices transmitted data to the data concentrator in the last 24 hours.

Function	Purpose
Processes Mobile Device Transaction Log Files	Mobile device communication sessions are automatically recorded on the data concentrator. These transactions are stored into historical logs. When there is more than one data concentrator, the Device Manager will collect all Mobile Device transaction logs and reassemble into chronology of events and stored as an integrated file.
Processes Asset Tracking Information	This function tracks the life cycle of an asset. Using the systems device management functions, data is generated and collected during normal network conversation to tell where a device has been used or stored.
Creates/Imports Device and Group Specific Data	Device and Group specific data sent to the deployed devices are entered into the system through the Device Manager. The device manager will accept manually created data or a file that contains the correct import format.

Function	Purpose
Creates/Imports Software Packages	Software Packages sent to the deployed devices are entered into the system through the Device Manager. The device manager will accept manually created data or a file that contains the correct import format. The device manager will automatically propagate the latest software version to the Data Concentrator for re-distribution to the individual devices.
Software Application Repository	Storage area for all software packages in the system. System physical components supported for this function are: Mobile Devices, Mobile Device Services Gateway, Workstation, and Data Concentrator Computer
Device Inventory Repository	Storage area for the relationship configuration of Mobile Devices and Mobile Device Services Gateway by deployed groups.
Device Specific Data Repository	Configuration information for each mobile device. This data is used for reports and system distribution to other devices such as the Data Concentrator, Mobile Device Services Gateway, and Mobile Device.

Function	Purpose
Asset Tracking Database	Storage of the data processed during the Processes Asset Tracking Information

Workstation internal common functions are described in Table 6.

Table 6 - Workstation Internal Common Functions

Function	Purpose
Provides Access to Peripherals for Mobile Device Business Applications	Share workstation peripherals such as Diskette drive, CD-ROM and Printers with Mobile Devices. Allows a mobile device to directly access a shared resource on a Workstation that is connected to the mobile device services gateway.
Performs Software Application Version Comparison in Preparation for Update	Device and Group specific data sent to the deployed devices are entered into the system through the Device Manager. The device manager will accept manually created data or a file that contains the correct import format.

Table 7 shows the relationships between the physical components (20, 30, 40, 50, 80). These relationships are the interfaces that define the behavior of the example system 10. In Table 7, the relationships are described by numeric value associated

with each interconnection shown in Fig. 2. Table 7 specifically describes these interconnections.

Table 7 - Interdependent Common Functions

Id#	Component #1	Component #2	Purpose
1	Device Management Computer	Data Concentrator Computer	Performs the data transfer of Mobile Device Transactions that are generated on the Data Concentrator. Should one or more Mobile Devices desire to communicate concurrently when associated with the same group, the system shall prevent multiples from communicating.
2	Device Management Computer	Data Concentrator Computer	Performs the data transfer of: Device and Group specific data to the Data Concentrator. Should one or more Mobile Devices desire to communicate concurrently when associated with the same group, the system shall prevent multiples from communicating.

Id#	Component #1	Component #2	Purpose
3	Device Management Computer	Data Concentrator Computer	Performs the distribution between two computers of the Device and Group Specific data. The system only allows this data to be transferred once to a group.
4	Device Management Computer	Data Concentrator Computer	Performs the distribution of software packages to the Data Concentrators.
5	Device Management Computer	Mobile Device Services Gateway	Initiates a field request to engage in remote diagnostics of a Mobile Device Services Gateway from a Device Management Computer. The data generated from the remote diagnostics may be transferred to the Device Management Computer.

Id#	Component #1	Component #2	Purpose
6	Mobile Device Services Gateway	Workstation	Request for common services of the Mobile Device Gateway. The workstation may request stored information to be transferred over to the workstation for data storage and specific business data processing and reports.
7	Data Concentrator Computer	Mobile Device Services Gateway	Performs time synchronization between the two devices. This time synchronization may not occur for each and every communication conversation. At a minimum a time synchronization will occur once a day unless forced by a user.
8	Data Concentrator Computer	Mobile Device Services Gateway	Performs the distribution of software packages to the Mobile Device Services Gateway.

Id#	Component #1	Component #2	Purpose
9	Data Concentrator Computer	Mobile Device Services Gateway	Performs the distribution between two computers of the Device and Group Specific data. The system only allows this data to be transferred once to a group.
10	Mobile Device	Data Concentrator Computer	Business data, Device and Group Specific Data are encrypted and decrypted when transferring data over the network.
11	Mobile Device	Workstation	Business data, Device and Group Specific Data are encrypted and decrypted when transferring data over the network.
12	Mobile Device	Mobile Device Services Gateway	Network security is enabled to insure that Mobile Devices are not able to directly access a businesses intranet.

Id#	Component #1	Component #2	Purpose
13	Mobile Device	Mobile Device Services Gateway	Request for common services of the Mobile Device Gateway. The Mobile Device may request stored information to be exported to a Diskette Drive located on the workstation. Or the Mobile Device may transfer data to the Mobile Device Services Gateway for the workstation to retrieve.
14	Mobile Device	Mobile Device Services Gateway	The Mobile Device Services Gateway performs the distribution of software packages to the Mobile Device.
15	Mobile Device	Mobile Device Services Gateway	The Mobile Device Services Gateway performs the distribution of Device and Group Specific data to the Mobile Device.

Id#	Component #1	Component #2	Purpose
16	Mobile Device	Mobile Device Services Gateway	Performs time synchronization between the two devices. This time synchronization may not occur for each and every communication conversation. At a minimum a time synchronization will occur once a day unless forced by a user.
17	Mobile Device	Mobile Device Services Gateway	A local message request is sent to the Mobile Device Services Gateway to initiate a remote process. This remote process may collect data from other Mobile Devices when requested by one Mobile Device.

Id#	Component #1	Component #2	Purpose
18	Mobile Device	Mobile Device Services Gateway	A remote message from the Mobile Device Services Gateway is received. The message requires the current software versions installed on the device. The Mobile Device responds by sending the list of software versions currently installed. The remote message response is complete and the Mobile Device waits for the next message.
19	Mobile Device	Mobile Device Services Gateway	A request of the Mobile Device Services Gateway for Device Management Information.
20	Mobile Device	Mobile Device Services Gateway	The Mobile Device receives a software update through the software distribution process.

Id#	Component #1	Component #2	Purpose
21	Mobile Device	Mobile Device Services Gateway	Device Management Information about the Mobile Device Services Gateway is sent. This information is collected prior to a communication session with the Data Concentrator.
22	Mobile Device	Mobile Device Services Gateway	Initiates a field request to engage in remote diagnostics of a Mobile Device Services Gateway from a Mobile Device. The data generated from the remote diagnostics may be transferred to the Mobile Device.
23	Mobile Device	Data Concentrator	Performs the data transfer of: Device and Group specific data to the Data Concentrator. Should one or more Mobile Devices desire to communicate concurrently when associated with the same group, the system shall prevent multiples from communicating.

Terminology used above is supplementally defined in Table 8.

Table 8 - Definitions

Term	Definition
Mobile Device	A data computing device that is portable and used by a human. The data computing device may have automated data input methods such as bar code readers, digitizers, voice recognition, magnetic stripe readers and optical character recognition
Mobile Device Management	The process of electronically managing the mobile device for the intent of collecting information or improving the common system functions. This may include but not be limited to software application updates, mobile device performance data, executing remote procedures (such as diagnostic or resource tools)

Term	Definition
Device and Group Specific Data	Information relating to a geographic location of the system or system components (i.e., Mobile Device, or Mobile Services Gateway). The information may consists (but not be limited to) of site name, address, telephone number, networking properties, associated information technology devices, business usage rules.

An example system 10 a device management computer 20, a data concentrator computer 30 for communicating with the device management computer, a gateway device 50 for communicating with the data concentrator computer, and a plurality of mobile data acquisition devices 80. Each of the plurality of mobile data acquisition devices 80 communicates with the gateway device 50. The gateway device 50 performs pre-processing functions on data collected by the plurality of mobile data acquisition devices 80 prior to transferring the data to the data concentrator computer 30.

Another example system 10 transfers data. The system 10 includes a device management computer20, a data concentrator computer 30 for communicating with the device management computer, a gateway device 50 for

communicating with the data concentrator computer, and a plurality of data acquisition devices 80. Each of the plurality of data acquisition devices 80 communicates with the gateway device 50. The gateway device 50 performs pre-processing functions on data collected by the plurality of data acquisition devices 80 prior to transferring the data to the data concentrator computer 30. The data concentrator computer 30 processes and stores data collected by the plurality of data acquisition devices 80.

An example computer program product (Fig. 2) controls a communication network 10. The computer program product includes a first instruction (step 1) for collecting transaction log files of a plurality of mobile devices 80 by a device management computer 20, a second instruction (step 4) for receiving a software package from the device management computer 20 by a data concentrator computer 30, a third instruction (step 5) for performing a self test by a gateway device 50 and sending results of the self test to a workstation 40, a fourth instruction (step 6) for decrypting data from the gateway device 50 by the workstation 40, and a fifth instruction (step 7) for synchronizing time between the plurality of mobile

devices 80, the gateway device 50, the device management computer 20, the data concentrator computer 30, and the workstation 40.

In order to provide a context for the various aspects of the present invention, the following discussion is intended to provide a brief, general description of a suitable computing environment in which the various aspects of the present invention may be implemented. While the invention has been described above in the general context of computer-executable instructions of a computer program that runs on a computer, those skilled in the art will recognize that the invention also may be implemented in combination with other program modules.

Generally, program modules include routines, programs, components, data structures, etc. that perform particular tasks or implement particular abstract data types. Moreover, those skilled in the art will appreciate that the inventive methods may be practiced with other computer system configurations, including single-processor or multiprocessor computer systems, minicomputers, mainframe computers, as well as personal computers, hand-held computing devices, microprocessor-based or programmable consumer

electronics, and the like. The illustrated aspects of the invention may also be practiced in distributed computing environments where tasks are performed by remote processing devices that are linked through a communications argument model. However, some, if not all aspects of the invention can be practiced on stand-alone computers. In a distributed computing environment, program modules may be located in both local and remote memory storage devices.

An exemplary system for implementing the various aspects of the invention includes a conventional server computer, including a processing unit, a system memory, and a system bus that couples various system components including the system memory to the processing unit. The processing unit may be any of various commercially available processors. Dual microprocessors and other multi-processor architectures also can be used as the processing unit. The system bus may be any of several types of bus structure including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of conventional bus architectures. The system memory includes read only memory (ROM) and random access memory (RAM). A basic input/output system (BIOS), containing the basic routines that help

to transfer information between elements within the server computer, such as during start-up, is stored in ROM.

The server computer further includes a hard disk drive, a magnetic disk drive, e.g., to read from or write to a removable disk, and an optical disk drive, e.g., for reading a CD-ROM disk or to read from or write to other optical media. The hard disk drive, magnetic disk drive, and optical disk drive are connected to the system bus by a hard disk drive interface, a magnetic disk drive interface, and an optical drive interface, respectively. The drives and their associated computer-readable media provide nonvolatile storage of data, data structures, computer-executable instructions, etc., for the server computer. Although the description of computer-readable media above refers to a hard disk, a removable magnetic disk and a CD, it should be appreciated by those skilled in the art that other types of media which are readable by a computer, such as magnetic cassettes, flash memory cards, digital video disks, Bernoulli cartridges, and the like, may also be used in the exemplary operating environment, and further that any such media may

contain computer-executable instructions for performing the methods of the present invention.

A number of program modules may be stored in the drives and RAM, including an operating system, one or more application programs, other program modules, and program data. A user may enter commands and information into the server computer through a keyboard and a pointing device, such as a mouse. Other input devices (not shown) may include a microphone, a joystick, a game pad, a satellite dish, a scanner, or the like. These and other input devices are often connected to the processing unit through a serial port interface that is coupled to the system bus, but may be connected by other interfaces, such as a parallel port, a game port or a universal serial bus (USB). A monitor or other type of display device is also connected to the system bus via an interface, such as a video adapter. In addition to the monitor, computers typically include other peripheral output devices (not shown), such as speaker and printers.

The server computer may operate in a networked environment using logical connections to one or more remote computers, such as a remote client computer. The remote computer may be a workstation, a server

computer, a router, a peer device or other common network node, and typically includes many or all of the elements described relative to the server computer. The logical connections include a local area network (LAN) and a wide area network (WAN). Such networking environments are commonplace in offices, enterprise-wide computer networks, intranets and the internet.

When used in a LAN networking environment, the server computer is connected to the local network through a network interface or adapter. When used in a WAN networking environment, the server computer typically includes a modem, or is connected to a communications server on the LAN, or has other means for establishing communications over the wide area network, such as the internet. The modem, which may be internal or external, is connected to the system bus via the serial port interface. In a networked environment, program modules depicted relative to the server computer, or portions thereof, may be stored in the remote memory storage device. It will be appreciated that the network connections shown are exemplary and other means of establishing a communications link between the computers may be used.

In accordance with the practices of persons skilled in the art of computer programming, the present invention has been described with reference to acts and symbolic representations of operations that are performed by a computer, such as the server computer, unless otherwise indicated. Such acts and operations are sometimes referred to as being computer-executed. It will be appreciated that the acts and symbolically represented operations include the manipulation by the processing unit of electrical signals representing data bits which causes a resulting transformation or reduction of the electrical signal representation, and the maintenance of data bits at memory locations in the memory system (including the system memory, hard drive, floppy disks, and CD-ROM) to thereby reconfigure or otherwise alter the computer system's operation, as well as other processing of signals. The memory locations where such data bits are maintained are physical locations that have particular electrical, magnetic, or optical properties corresponding to the data bits.

It will be understood that the above description of the present invention is susceptible to various modifications, changes and adaptations, and the same

are intended to be comprehended within the meaning and range of equivalents of the appended claims. The presently disclosed embodiments are considered in all respects to be illustrative, and not restrictive. The scope of the invention is indicated by the appended claims, rather than the foregoing description, and all changes that come within the meaning and range of equivalence thereof are intended to be embraced therein.